

CLAIMS

1. A controllable optical lens, comprising:
a chamber housing first and second fluids (10,12), the interface
5 between the fluids defining a lens surface (15);
an electrode arrangement (14,16,40,50,70) for electrically controlling
the shape of the lens surface and for sensing the shape of the lens surface,
the electrode arrangement comprising a plurality of electrode segments
(40,70) at different angular orientations about an optical axis of the lens; and
10 a sensing arrangement (80) for determining, from at least the plurality of
electrode segments (40,70), lens surface characteristics at a plurality of
angular orientations.
2. A lens as claimed in claim 1, wherein the sensing arrangement (80)
15 comprises a capacitance sensing arrangement.
3. A lens as claimed in claim 1 or 2, wherein the electrode arrangement
comprises:
a drive electrode arrangement comprising a base electrode (14) and a
20 side wall electrode (16).
4. A lens as claimed in claim 3, wherein the electrode arrangement further
comprises a patterned top electrode (40), which comprises the plurality of
electrode segments.
- 25 5. A lens as claimed in claim 4, wherein the patterned top electrode (40) is
made from a substantially transparent electrically conductive material.
6. A lens as claimed in claim 5, wherein the patterned top electrode is made
30 from ITO.

7. A lens as claimed in claim 4, 5 or 6, wherein the side wall electrode (16) comprises an annular electrode which surrounds the chamber.
8. A lens as claimed in claim 7, wherein the side wall electrode (16) comprises a first driving electrode portion and one or more sensing electrode portions (50), the sensing electrode portions comprising annular electrodes surrounding the chamber and spaced along the optical axis from the driving electrode portion.
9. A lens as claimed in any one of claims 4 to 8, wherein the sensing arrangement comprises a capacitance sensing arrangement for sensing the capacitance defined between pairs of the electrode segments.
10. A lens as claimed in any one of claims 4 to 8, wherein the sensing arrangement comprises a capacitance sensing arrangement for sensing the capacitance defined between each of the plurality of electrode segments and the side electrode.
11. A lens as claimed in claim 8, wherein the sensing arrangement comprises a capacitance sensing arrangement for sensing the capacitance defined between a plurality of pairs of electrodes, the pairs each comprising one of the plurality of electrode segments (40) and one of the sensing electrode portions (50) of the side electrode.
12. A lens as claimed in claim 3, wherein the drive electrode arrangement comprises a plurality of side wall electrodes (70) disposed angularly spaced around the chamber, and wherein the plurality of side wall electrodes comprise the plurality of electrode segments.
13. A lens as claimed in claim 12, wherein the sensing arrangement (80) comprises a resistance sensing arrangement for sensing the resistance

between each of the plurality of electrode segments (70) and the base electrode (14).

14. A lens as claimed in claim 12, wherein the sensing arrangement (80)
5 comprises a capacitance sensing arrangement for sensing the capacitance defined between each of the plurality of electrode segments (70) and the base electrode (14).

15. A lens as claimed in claim 12, further comprising a top electrode.

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16. A lens as claimed in claim 15, wherein the top electrode comprises a single central electrode.

17. A lens as claimed in claim 16, wherein the sensing arrangement
15 comprises a capacitance sensing arrangement for sensing the capacitance defined between each of the plurality of electrode segments (70) and the top electrode.

18. A lens as claimed in claim 15, wherein the top electrode comprises a
20 comprises a patterned top electrode, which comprises a plurality of top electrode portions.

19. A lens as claimed in any one of claims 15 to 18, wherein the top
25 electrode is made from a substantially transparent electrically conductive material.

20. A lens as claimed in claim 19, wherein the top electrode is made from ITO.

30 21. A lens as claimed in any one of claims 1 to 12 or 14 to 30, wherein the sensing arrangement (80) comprises a capacitance sensing arrangement comprises an alternating current source (26) for applying a first signal to a first

electrode of a selected pair of electrodes, and a combiner (30) for combining a second signal received from a second electrode of a selected pair of electrodes with the first signal, and a filter (32).

- 5 22. A lens as claimed in any preceding claim, wherein the first fluid (10) comprises a polar and/or conductive liquid and the second fluid (12) comprises a nonconductive liquid.

23. A lens system comprising:
10 a lens and sensing arrangement as claimed in any one of claims 12 to 20; and
a drive arrangement for providing independently controllable drive voltages to the plurality of side wall electrodes based on the sensing arrangement outputs.

- 15 24. A lens system comprising:
a lens and sensing arrangement as claimed in any one of claims 1 to 22; and
a drive arrangement for providing a drive voltage to the electrode
20 arrangement based on the sensing arrangement outputs.

25. A controllable optical lens, comprising:
a chamber housing first and second fluids, the interface between the fluids defining a lens surface;
25 an electrode arrangement for electrically controlling the shape of the lens surface and for sensing the shape of the lens surface, the electrode arrangement comprising a plurality of electrode segments at different linear positions along the optical axis of the lens; and
a sensing arrangement for determining, from at least the plurality of
30 electrode segments, lens surface characteristics at a plurality of linear positions along the optical axis.